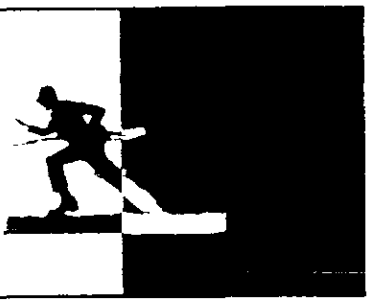
TRAINING NOTES



The M249 Machinegun

KENNETH D. MARTZ

The latest addition to the infantryman's fighting arsenal is a weapon soldiers have needed since the retirement of the Browning automatic rifle. While the M16A1 serves well in the automatic rifle role, it does not have the firepower required to support squad maneuver on today's battlefield. The story of the development of the M249 machinegun—the squad automatic weapon (SAW) for the 1990s—is an interesting one.

The hunt for such a weapon began in earnest in 1966 with a weapons study that determined the requirements for the SAW. It had to be capable of neutralizing the enemy at ranges equal to the depth of a rifle company, and it had to be a one-man system with a density of two per squad to support fire team movement.

This prompted further studies to find a smaller caliber weapon with enough firepower in terms of range, penetration, and lethality while offering a weight advantage over the 7.62mm round, which was the standard round at the time. At seven pounds per 100 rounds, a SAW in 7.62mm caliber with 500 to 600 rounds would exceed 50 pounds, not desirable for sustained infantry tactics. The studies determined that 6mm would be the best size, with 5.56mm as second best. In 1974, for various reasons, 5.56mm was finally chosen.

Two years later, in 1976, the Army formulated a requirements document that called for a weapon with operational characteristics similar to those of the M60 machinegun. Testing began early in 1979 to choose a nondevelopmental item (an acquisition process to buy "off-the-shelf" equipment). From the candidate weapons tested, in late 1979 the *Fabrique Nationale* (Belgium) Minimi was selected as the best.

AMMUNITION

Earlier that same year, NATO had selected the Belgian SS109/SS110 5.56mm round as a standard NATO caliber. This action also prompted a U.S. Army decision to make its future weapons compatible with the NATO round. Thus the M249 evolved. The new 5.56mm ammunition is now standard Army issue and is used in the M16A2 rifle as well.

Why did the United States adopt a new 5.56mm round when it already had one? The answer is simple. There is a considerable difference between the U.S. M193/M196 (used in the M16A1 rifle) and the SS109/SS110, which is now made in the U.S. and designated by the U.S. Army as M855 ball and M856 tracer rounds. In terms of interoperability, either type of ammunition can be fired safely in all U.S. Army 5.56mm weapons. But there are performance drawbacks related to the difference in barrel twist between the M16A1 (1:12 twist) and the M249 and M16A2 (1:7). The correct barrel twist is necessary to ensure the best accuracy and lethality of the bullet.

When M193/M196 ammunition is fired from the M249 or the M16A2, the bullet is overstabilized but about as accurate as when it is fired from an M16A1 rifle. But the weapon's terminal performance is degraded. When M855/M856 ammunition is fired from the M16A1, there is not enough spin to stabilize the bullet and its accuracy is reduced, making it difficult to repeatedly hit a man-size target beyond 100 meters. (Table 1 lists the basic characteristics of the two types of 5.56mm rounds, along with those of the 7.62mm M80/M62 ammunition for comparison.)

Downrange performance is much better with M855/M856 ammunition because the bullets are longer, heavier, and aerodynamically more efficient; too, the M855 round contains a steel

penetrator for better performance against hard targets. The result is a higher retained velocity at ranges beyond 400 meters. This higher velocity plus the M855's steel penetrator produces range and penetration roughly equivalent to that of the 7.62mm M80 ball round and at half the weight.

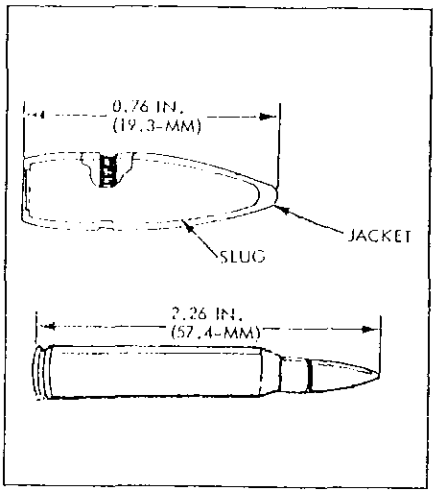
The M249 machinegun is an air-cooled, gas-operated weapon. It is normally belt-fed from 200-round plastic containers or, in an emergency, can be fed from M16 rifle magazines and fires from the open-bolt position (Table 2 lists its characteristics). Open-bolt operation allows a light-weight weapon to sustain a nominal firing rate without cooking off. Open-bolt firing begins and ends with the bolt open, locked to the rear. At no time does a live round remain in the chamber unless there is a malfunction.

The M249 has a quick-change barrel capability with a fixed headspace. For safety reasons, the headspace must be verified by direct support personnel before a quick-change barrel is used on a particular receiver, just as is required with the M60.

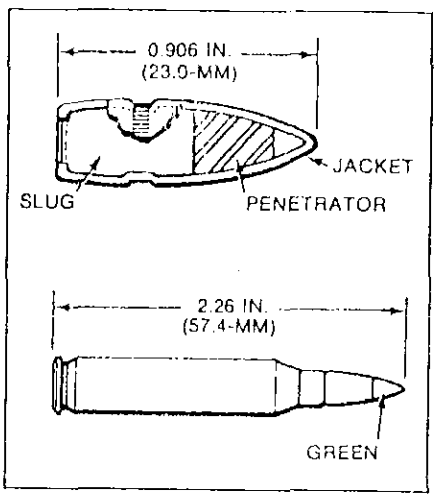
The basis of issue narrative for TOE application designates the M249 as a one-for-one replacement for the M16A1 automatic rifle. In the infantry, this means two per squad. Other TOEs designate automatic rifles according to the units' needs.

In an infantry squad, the M249 forms the basis of maneuver for each fire team. Depending on the factors of METT-T, a platoon leader may designate control of the SAWs to the squad leaders or retain control himself and use them as a weapons section.

About 8,000 M249s are now in troop and training units. The 82d Airborne Division is completely filled as well as the Rangers and the active Special Forces units. All remaining active infantry battalions (except for the 5th Infantry Division and elements of the 4th Infantry Division) and the Reserve Component roundout battalions have M249s in the automatic rifle role. The 5th Division and the remainder of the 4th will not receive any M249s until Fiscal Year 1991.



M193 5.56mm Ball Cartridge



M855 5.56mm Ball Cartridge

PERFORMANCE COMPARISON OF AMMUNITION

	M193/196	M855/856	M80/M62
Muzzle velocity (FPS)	3250	3025	2750
Maximum range (meters)	2650	3600	3750
Tracer burn (meters)	400	900	860
Grazing trajectory (meters)	*	600	600
Weight (lbs/100 rounds)	3.45	3.45	7.0
Penetration			
10-gauge steel (range in meters)	390	630	620
U.S. M1 Helmet w/liner (range in meters)	515	1150	1025
Pine boards (at 800 meters)	*	6.0 in	7.5 in
Aluminum plate (at 800 meters)	*	0.188 in	0.188 in
Plexiglas (aircraft)(range in meters)	*	925	925

* Data not available

Table 1

The M249 system is fielded as a total package made up of the items shown in Table 3.

The fielding of the M249 began in April 1984. By early 1985 several deficiencies were noted. Some of these were a carrying handle that bent or broke during airborne operations, a front sight block that loosened, a hot barrel that burned a soldier's hands, and bipod legs that extended when they weren't supposed to. In addition, there was initially no ammunition to shoot, no storage racks, and no training materials or spare parts.

A joint task force formed in September 1985 sorted out the hardware problems and gained approval in October to proceed with modifications to be retrofitted to all existing M249s and to be incorporated into future production. To date, all of the modifications have been field tested and accepted by the soldiers. (Table 4 lists 18 fixes that have been or will be applied.)

Aside from these modifications, there have been some new problems and complaints:

First, the 200-round ammunition container is noisy and falls off the weapon during training. Efforts at solving this problem are directed at redesigning the container to strengthen the attaching point, employing sound-absorbent plastics, and investigating a smaller container. It is reported that

M249 MACHINEGUN CHARACTERISTICS

Overall length (in)	40.87
Barrel length (in)	20.2
Weight (lbs)	15.16
Spare barrel weight (lbs)	3.65
Sustained rate of fire (RPM)	85
Maximum effective range (m)	
Point target	600
Area target	800
Suppression	1000

Table 2

some units are repacking the containers with cardboard liners, but this is not recommended. Engineers are working on an interim solution to the noise problem in the form of an insert that will not be affected by environmental conditions such as moisture. A payoff from this improvement effort is expected in late Fiscal Year 1989.

Second, there is no way for a user to know when a barrel is worn out. (If accuracy suffers and bullets start hitting the wrong hill, it's probably the barrel.) Before sending a weapon to direct support maintenance for an unsolved accuracy problem, however, a user should make sure it is zeroed according to Change 2 of the operator's manual, and that both the front and rear sights are in proper working order. The DS people will determine the barrel's condition. It will then be swapped out or returned to service. Unfortunately, many bad barrels are being returned to service because the present erosion gauge does not accurately indicate the correct state of the barrel. A new gauge should be available in Fiscal Year 1989.

The barrel on the M249 must have a minimum life of 10,000 rounds, but tests repeatedly show that barrel life exceeds 20,000 rounds, some more than 32,000. Of course, these numbers are obtained during tests conducted by firing the weapon at the rates prescribed in the operator's manual. If the schedules in the manual are exceeded, the life expectancy of a barrel as well as the rest of the weapon will be reduced.

Nevertheless, some users believe that the barrels have a short life. Although no cumulative round count is required for each weapon, the number of barrels being replaced indicates that more rounds are being fired (including blanks) than leaders realize. The current M249 has a dual rate of fire: 750 rounds per minute (RPM) normal and 1,000 RPM adverse. Continual operation at the adverse rate reduces the life of the weapon, and interviews with soldiers reveal that they normally fire the M249 at 1,000 RPM.

This leads to a training question: Why fire blanks in the adverse mode and 4:1 linked rounds in the normal mode during the day and both at night in the adverse mode? Although this is not an ideal training regimen, it offers the best operation of the current weapon, which functions more reliably in the adverse mode when firing blanks. Firing in the adverse mode at night also reduces the flash signature. The M200 blank does not produce enough power to operate the bolt group reliably using the normal rate of fire. (The new gas system eliminates this problem.)

At the present time, much of the problem with the weapon when blanks are being used is caused by the blank adaptor. The correct adaptor is the M15A2, the same one used with the M16A2 rifle. (It is readily identifiable by a ring attached to the screw as opposed to the "T" handle found on the older adaptor.) Installation is described in the operator's manual. The secret is to retighten the screw after an initial barrel warm-up of 50 rounds or so. It should be finger tight only; over-torquing tends to stretch the frame of the adaptor.

Procedures for zeroing the AN/PVS-4 with the M249 have been formulated and should have reached the field by now. These procedures are identical to those for the M60

THE M249 SYSTEM

M249 machinegun
M113 storage rack
AN/PVS-4 sight adaptor and sight
MILES training device
M855/M856 ball and tracer ammunition linked 4:1
M855 linked for special-purpose application
M200 blank linked for training
M15A2 blank firing adaptor
SAW/utility ammunition pouch, two per automatic rifleman
TM 9-1005-201-10 dated September 1983 with Change 2 dated 2 June 1986
TM 9-1005-201-23&P dated April 1984 with Change 1 dated 2 June 1986
FM 23-14 dated December 1985

Table 3

M249 PROBLEMS AND FIXES

PROBLEM	FIX
Cut hands on link ejector cover	*Remove cover
Firing pin spring is easily lost	*Crimp spring
Front sight loosens	*Install larger lock key
Windage and elevation knobs freeze	*Increase clearance
Detent pins on sight knobs wear	*Replace with ball bearings
Bipod legs extend inadvertently	*Install stronger spring
Excessive stoppages with M16 magazines	*Resize magazine well
Hot barrel burns hands	Install heat shield
Fixed carrying handle unacceptable	Folding carrying handle
Takedown pin pulls from receiver	New pin design
Buttstock breaks	New synthetic stock
Excessive flash	Fix gas system
Excessive signature	M16A2 suppressor
Left hand threads on barrel	Change to right hand
Rate of fire increases	Hydraulic buffer
Firing pin tip deforms	*New change criteria
Operator can't adjust front sight	*Put special tool in unit
Rear peep falls off	*New zero procedures

*Already applied.

TABLE 4

except that the M16 reticle is used and the shot center of impact is nine centimeters down from and two centimeters left of the aiming point. In any event, the iron sights are fully functional with the AN/PVS-4 mounted. With a properly zeroed weapon, the scope can be referred to the iron sights.

Numerous comments are received about the inability of the M249 to record enough kills when using the MILES training device. Assuming that the device is aligned properly and the weapon is zeroed, the following is offered for thought: The M16A1 MILES transmitter is used on the M249, and the range of the transmitter is 460 meters. Therefore, the employment of the M249 beyond this range, which it is certainly capable of, will not produce any kills. In fact, few will be recorded beyond 300 meters. If a unit has the tunable transmitter, it should be set to the range capability of the weapon, which is listed in the operator's manual.

The future is bright for the M249. A contract will be let by the end of this fiscal year to procure retrofit kits to upgrade the 8,000 M249s in the field, and the kits will be available in Fiscal Year 1989. A five-year contract is being negotiated to procure more than 20,000 weapons. If this goes through, the fielding of the production M249s should begin in Fiscal Year 1991.

Efforts are continuing to procure a traverse and elevation (T&E) adaptor to permit mounting the M249 on the M122 tripod. A new bore erosion gauge should appear in Fiscal Year 1989 and the 200-round container fixes should follow soon. The normal equipment improvement cycle will continue with efforts directed toward increasing the weapon's accuracy, refining its sights, and improving its reliability.

In its class, the M249 in its present configuration has no equal in terms of firepower and reliability, and soon it will be even better. This is not a parochial opinion but one that is shared by the U.S. Marine Corps, the Canadians, and the Australians. Hopefully, any bad impressions and false rumors caused by its rocky beginning will pass.

While the future looks bright, the present does not. Since there will be no more M249s until Fiscal Year 1991, those on hand must be maintained so they can bridge the gap. If commanders and noncommissioned officers will emphasize the need for proper training, discipline, and maintenance, these weapons will perform when they must and will last until more are available.

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EPLRS
Where Are You? I Am Here.

MAJOR DAVID A. PRIOR

In the fog of battle, on the fluid, lethal, modern battlefield, how does a maneuver commander keep his finger on the tempo of friendly and enemy actions? How does he synchronize the variety of lethal weapon systems at his disposal to meet the enemy and destroy him at the most convenient time and place? How does he—in the middle of the night, in the rain and the snow—bring together the speed and lethality of M1 tanks, M2 IFVs, multiple-launch rocket systems, and Apache helicopters in an orchestrated and synchronized attack?

A requirement for moving this kind of information around the battlefield from "him who has it" to "him who needs it" has existed throughout the modern era. No current command and control system meets this requirement for the commander, but such a system is coming whose advantages are now being field tested by the U.S. Marine Corps. The system is the Position Location Reporting System (PLRS) or, for the Army, Enhanced PLRS (or EPLRS).

Of all the command and control systems that are being developed for or fielded in the Army today, EPLRS will make the most significant contribution to the successful employment of the tenets of AirLand Battle doctrine—more than SINCGARS, more than mobile subscriber equipment. EPLRS is scheduled to reach field units during Fiscal Year 1993.

EPLRS will tell a maneuver commander, or any user equipped with it—automatically, by an eight-digit grid coordinate—where everyone who